HEALTHY COASTAL ECOSYSTEMS FOCUS TEAM

HABs IMPACTS

OCTOBER 2009

947 ALASKA: Alaska Sea Grant increased awareness of paralytic shellfish poison and harmful algal blooms

Activity Summary: A decades long PSP awareness and education outreach effort has been successful in limiting PSP illnesses among Alaskans and visitors. During this reporting period, MAP held five workshops, two training sessions, and a presentation at the Alaska Health Summit. Impact Statement: During 2007, there was one reported PSP illness. This is the lowest level of illness recorded since formal testing began in 1973. Residents of Kodiak Island, where subsistence shellfish gathering has been culturally important, have largely avoided shellfish in large measure because of the education and outreach efforts conducted there. Activity Summary: MAP was a co-PI on a North Pacific Research Board funded project titled, Response and Intervention System for Climate Change Induced Paralytic Shellfish Poisoning (PSP) in Aleut Communities, PSP Monitoring and Outreach. During the two years of the project, nine community technicians were trained in the standard operational procedure for sampling, storing, testing, and shipping of shellfish samples. About 150 samples were tested from nine species of shellfish. Outreach included reports delivered to over 500 persons in 19 communities and progress posted on five Web sites. Impact Statement: This project extended the range of known PSP occurrence in shellfish ranging from King Cove, Alaska, to the Commander Islands, Russia. PSP values are now available for subsistence harvest shellfish species not previously tested. Communities received and were receptive to the information provided. A sustained monitoring program was established in King Cove. This monitoring program is significant because residence of this small community of 150 residents regularly ship their harvest to communities as far away as Seattle, and to an estimated 1,000 Native American shellfish consumers. In 2007, after detecting PSP in Bering Sea blue mussels and surf clams, King Cove voluntarily suspended shellfish shipments. *[(hab dis wq fish train cli)]*

1414 NEW YORK: Sea Grant researchers establish a regional laboratory to monitor algal toxins in water bodies

Cyanobacterial blooms and their associated toxins have caused environmental and human health problems worldwide. To investigate the occurrence of anatoxin-a in the lower Great Lakes, nearly 1500 water samples were collected from Lakes Ontario, Erie and Champlain between 2001 and 2004, and the anatoxin-a content determined using HPLC after fluorometric derivatization. Anatoxin-a was found in 2% of the samples from Lake Ontario, 5% of the samples from Lake Erie, and 4% of the samples from Lake Champlain. Overall the anatoxin-a concentrations were low (less than 0.01 micrograms per liter), with the highest concentrations observed in Lake Champlain (6.3 micrograms per liter) and Lake Ontario (1.4 micrograms per liter). Few samples had anatoxin-a concentrations that exceeded 0.5 micrograms per liter, suggesting that despite the highly publicized animal fatalities in Lake Champlain; acute toxicity from the neurotoxic anatoxin-a is likely to be rare. Anatoxin-a was relatively unstable (half-life ~5hr) in natural waters when exposed to UV light and higher pH levels (>8) similar to those which occur during a cyanobacterial bloom. IMPACT: Instability of anatoxin-a has important implications for management because samples collected in the later stages of a bloom may underestimate the actual risk from this toxin. Thus to facilitate monitoring, the researchers established a regional monitoring laboratory for anatoxin-a, offered training workshops for outside agencies in measuring anatoxin-a, and worked to develop a rapid monitoring technique for this neurotoxin. They have developed a prototype two-step Enzyme-Linked Immunosorbent Assay (ELISA) for this toxin which is sensitive to 0.6 micrograms per liter. This new ELISA shows good correlation (R2= 0.96) with the fluorometric HPLC method when both were used to analyze natural field samples for anatoxin-a. The lead researcher is

currently working with several different biotechnology firms to investigate new coupling techniques for formation of additional antibodies against anatoxin-a. *[R/XO-2 (train mon hab)]*

1424 NORTH CAROLINA: Detecting and Quantifying Algal Blooms

Sea Grant research results have improved the means of detection, taxonomic characterization and quantification of phytoplankton bloom species, including toxic and other nuisance taxa. Field data have also been used to calibrate satellite and aircraft-based remote sensing of Chl a and other diagnostic (of phytoplankton groups) photopigments, enabling investigators and managers to "scale up" to the ecosystem level. See Paerl et al. 2003, Bioscience 53(10) 953-964. *[R/MER-45 (mon hab)]*

1425 NORTH CAROLINA: DYNAMICS OF NUTRIENTS, PHYTOPLANKTON AND CHLOROPHYLL A

Project results indicate that both the amounts and composition of new nitrogen entering the Neuse R. Estuary-Pamlico Sound continuum are important drivers of phytoplankton community composition and activity. In a nutrient management context, this means that human activities impacting both the amount and quality of N sources must be carefully monitored and managed. Sea Grant research results are having major impacts on the formulation (calibration), evaluation and verification of the EPA- and State of North Carolina (Dept. of Envirnment and Natural Resources-DENR)-mandated Total Maximum Daily (N) Load (TMDL) for the Neuse River Estuary. The role of organic N has also been shown to be important in eutrophication of these and other N-limited estuarine ecosystems. Lastly, the means of N delivery (i.e. chronic vs. acute) proved to be very important in phytoplankton productivity and compositional responses. Since tropical storm and hurricane activities are predicted to increase over the next 10-40 years, careful consideration must given to how episodic runoff and flooding events will impact production, nutrient cycling and food web dynamics of these ecosystems. *[R/MER-47 (hab wq)]*

109 WHOI: Sea Grant researchers transfer technology for forecasting harmful algal blooms to private company

Sea Grant researchers have developed molecular probes that differentiate and enumerate the species responsible for harmful algal blooms (HABs). The probes are used to rapidly characterize bloom conditions and the potential threat of toxin accumulation in shellfish stocks. The probes have been commercialized by Saigene, Inc., and were very effective in predicting the extensive red tide conditions experienced off the New England coast during the spring and summer of 2005. *[(hab)]*

1 WISCONSIN: Wisconsin Research Provides Timely Data on Potentially Harmful Algae

Sea Grant-funded researchers have collected new data on the abundance and spatial pattern of potentially harmful algae blooms (Cyanobacteria) over the past 5 years. The data have been collected with methods and at locations consistent with work completed during the 1980s. IMPACT: This work provides the only currently available data on current and past trends in abundance in Green Bay of Cyanobacteria taxa known to produce toxins. *[R/LR-93 (hab)]*

1681 WOODS HOLE OCEANGRAPHIC INST.: Sea Grant researchers transfer technology for forecasting harmful algal blooms to private company

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26 MARYLAND: Research improves HAB monitoring and prediction in Chesapeake Bay

The project led to improved monitoring HAB species by state agencies and enhanced ability to predict bloom formation based on monitoring cryptophyte abundance/HAB predator relationships See Eyes on the Bay (http://mddnr.chesapeakebay.net/hab/HAB_maps.cfm). *[R/EH-5 (hab)]*

1561 SOUTHERN CALIFORNIA: Sea Grant research enables prediction of phytoplankton bloom response by identifying transport of suspended fine particulates in nearshore waters

Research generated by collaborations with ECOHAB and MERHAB programs studying harmful algal blooms by analyzing remote sensing observations has been correlated with field based studies, allowing for watershed modeling that allows prediction of the likelihood of potential threats to human and ecosystem health. *[R\ CE-13 (hab mon mod)]*

137 TEXAS: Texas Sea Grant trains volunteers for red tide detection (2008)

Texas Sea Grant's Cameron County coastal and marine resources extension agent was one of the trainers for the Red Tide Rangers, a group of 32 volunteers organized out of the Rio Grande Valley Master Naturalist Chapter to monitor and collect samples in support of the Phytoplankton Monitoring Network, a national monitoring program that serves as an early detection program for hazardous algal blooms. During this reporting period, Red Tide Rangers detected large numbers of Dynophysis, a single cell organism responsible for causing diarrheic shellfish poisoning related to shellfish consumption. The Texas Department of State Health Services closed shellfish waters in Texas to avert consumption of shellfish contaminated with this organism. Periodic sampling and information for hazardous algal blooms helps avert unnecessary economic losses from tourists avoiding the area as a result of hazardous algal bloom 'hysteria.' A red tide scare in the 1990s coincided with a 10 percent drop in hotel/motel tax revenues on South Padre Island. During the reporting period, volunteers logged roughly 100 hours, which had an estimated market value of about $1,800. Also, in addition to supporting the Hazardous Algal Bloom Workgroup in Texas, the samples and information collected by the volunteers in 2005 is also being used in a UT Brownsville study of the impact of the brevetoxin aerosol on inshore animals. The Red Tide Rangers project is being studied as a model for a statewide initiative. *[A/F-1 (hab train)]*

138 TEXAS: Texas Sea Grant-trained volunteers detect harmful marine organism (2009)

Texas Sea Grant's Cameron County coastal and marine resources extension agent was one of the trainers for the Red Tide Rangers, a group of 32 volunteers organized out of the Rio Grande Valley Master Naturalist Chapter to monitor and collect samples in support of the Phytoplankton Monitoring Network, a national monitoring program that serves as an early detection program for hazardous algal blooms. During the reporting period, Red Tide Rangers volunteers detected large numbers of Dynophysis, a single-cell organism responsible for causing diarrheic shellfish poisoning related to shellfish consumption. The Texas Department of State Health Services closed shellfish waters in Texas to avert consumption of shellfish contaminated with this organism. *[A/F-1 (hab train)]*

139 TEXAS: Texas Sea Grant trains volunteers to monitor for harmful algal bloom (2009)

The Texas Sea Grant-trained Red Tide Rangers volunteer group regularly monitor the waters of the Lower Laguna Madre for Karenia brevis and other possibly harmful organisms. Periodic sampling and information for hazardous algal blooms helps avert unnecessary economic losses from tourists avoiding the area as a result of hazardous algal bloom "hysteria." A red tide scare in the 1990s coincided with a 10 percent drop in hotel/motel tax revenues on South Padre Island. In addition to supporting the Hazardous Algal Bloom Workgroup in Texas, the samples and information collected by the volunteers in 2005 is also being used in two UT Brownsville studies on the impact of the brevetoxin aerosol on inshore animals and brevetoxin's effects on cellular synapses. The Red Tide Rangers project is being studied as a model for a statewide initiative. *[A/F-1 (hab train)]*

1642 WASHINGTON: Sea Grant supports tools to detect toxic algae and predict harmful algal blooms

Heterosigma blooms create toxic conditions for marine ecosystems and aquaculture by forming dense surface aggregations. The aggregations are caused in part by cells' vigorous swimming behaviors that interact strongly with estuarine flows to concentrate or disperse potential HABs. Heterosigma cells transition into resting cells (cysts) when environmental conditions become unfavorable; transitioning cells are believed by aquaculturists to be highly toxic to penned fish, and cysts are sources of future HABs. Sea Grant research has developed three techniques to address Heterosigma blooms: (1) video- and computer-based techniques to automatically quantify the number and sinking rates of transitioning cells and cysts in water samples; (2) an inexpensive optical imager that can quantify swimming characteristics of Heterosigma cells in their natural environment; and (3) computationally efficient methods to estimate transport of algal cell populations due to diurnal shifts in swimming behavior and seasonal or tidal changes in estuarine flows. Impact: These tools respectively provide: (1) a basis for assessing toxicity due to transitioning cells and predicting the abundance and location of cyst beds that may cause future HABs; (2) fine-scale observations of cell distributions and behaviors that offer an accurate basis for prediction of HAB location and timing; and (3) an efficient and effective tool for determining the conditions likely to promote HAB formation in estuarine environments. *[R/B-52 (mon hab)]*

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